FLASH TANK FOR ECONOMIZER REFRIGERATION SYSTEMS

BACKGROUND OF THE INVENTION

[0001] This invention relates to capacity and efficiency control of refrigeration systems, and in particular, to a flash tank economizer for enhancing the performance of a refrigeration system. As will be explained below, the present invention involves a novel configuration of a flash tank economizer configuration that utilizes a system of internal baffles to produce expansion of refrigerant liquid, separation of the resulting refrigerant gas from the remaining refrigerant liquid, and temporary storage of both the refrigerant gas and liquid before conveying them to other components of the refrigeration system.

[0002] A typical compression refrigeration system is composed of the following components: an evaporator for exchanging heat between a medium to be cooled and a refrigerant; a compressor that takes the low-pressure gas refrigerant generated in the evaporator and compresses the gas to a suitable higher pressure; a condenser that facilitates the heat exchange between the high-pressure refrigerant and another fluid (such as ambient air or water) resulting in conversion of the high pressure gas to high pressure liquid; an expansion device for receiving high pressure liquid from the condenser and expanding the liquid to yield low pressure liquid and some low pressure refrigerant gas; and biphasic piping connecting the expansion device to an evaporator.

[0003] In addition to the basic components described above, the refrigeration system can also include other components intended to improve the thermodynamic efficiency or performance of the system. In the case of a multiple stage compression system, and also with screw compressors, an "economizer" circuit may be included to improve the efficiency of the system and for capacity control. Economizer circuits are utilized in compression refrigeration systems to provide increased cooling or heating capacity. Such use of economizer circuits is well known within the art.

[0004] One type of economizer circuit involves drawing of refrigerant gas from an intermediate pressure stage of the compression cycle to reduce the amount of gas

compressed in the next compression stage, thus increasing efficiency of the motor during the next compression stage. The medium-pressure gas is typically returned to suction or to an intermediate compression stage, where it may slightly increase the pressure of suction gas flowing to the compressor, further reducing the amount of compression required by the compressor.

[0005] Another type of economizer circuit increases system capacity and efficiency by drawing some high pressure refrigerant from the condenser, routing the drawn refrigerant through an expansion device to lower the pressure and temperature of the refrigerant, and returning the resulting intermediate-pressure refrigerant to various points in the refrigeration circuit. This second type of economizer circuit is customarily incorporated in the high-pressure flow line just downstream of the condenser. A portion of the refrigerant leaving the condenser is tapped from the main flow line, and is passed through an economizer expansion device. An economizer heat exchanger, such as a flash tank, receives the refrigerant leaving the economizer expansion device. Within the flash tank, a portion of the refrigerant expands to form intermediate pressure gas, and the remainder of the refrigerant is converted to an intermediate pressure liquid phase. The intermediate pressure gas phase is returned to the compressor, preferably at an intermediate compression stage of a multiple stage compressor, where it will require less compression to reach a pre-selected pressure, thus increasing compressor efficiency. The intermediate pressure liquid phase is returned from the flash tank to the main flow line at a point before the main flow enters the primary expansion device leading to an evaporator. Upon entry into the main flow line, the intermediate pressure liquid refrigerant from the economizer circuit expansion device cools the main flow of refrigerant. Because the refrigerant reaching the primary expansion device has been pre-cooled, greater cooling capacity of the evaporator is achieved.

[0006] Known flash tanks for use in economizer circuits are relatively complex structures. For example, known flash tanks have complex arrangements of internal baffles, floats, phase separation screens, and other components. For example, the flash tanks shown and described in U.S. Patent No. 5,692,389 and U.S. Patent No. 4,232,533 include complex arrangements of chambers, floats, wire screens, baffles,